

Table 3. Results of studies of manganese-exposed workers based on neurobehavioral assessments (Mergler and Baldwin, 1997)

Reference (exposed + controls)	Motor functions	Hand steadiness	Response speed	Diadocho- kinesia	Memory	Other intellectual functions	Olfactory sensitivity	Mood state
Siegl and Bergert (1982) (25 + 21)			•					
Roels <i>et al.</i> (1987) (141 + 104)	•	•	•		•			
Wennberg <i>et al.</i> (1991) (30 + 90)	•			•		•	n.s.	
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Roels <i>et al.</i> (1992) (92 + 101)		•	•					•
Chia <i>et al.</i> (1993) (17 + 17)	•				•	•		
Mergler <i>et al.</i> (1994) (74 + 74)	•	•	n.s.	—	n.s.	•	•	•
Beuter <i>et al.</i> (1994) (10 + 10)				•				
Lucchini <i>et al.</i> (1995)	•		n.s.			•	•	

Table 2. Demographics and internal exposure parameters for studies of manganese-exposed workers (Mergler and Baldwin, 1997)

Reference (exposed + controls)	Type of plant	Mean age of exposed	Years of exposure, mean \pm SD (range)	MnB of exposed, geometric mean (μ g/100 ml)	MnB of controls, geometric mean (μ g/100 ml)	MnU of exposed, geometric mean (μ g/g cr)	MnU of controls, geometric mean (μ g/g cr)
Roels <i>et al.</i> (1987) (141 + 104)	Mn oxide and salt	34.3 \pm 9.6 (19—59)	7.1 \pm 5.5 (1—19)	1.22	0.49	1.59	0.15
Wennberg <i>et al.</i> (1991) (30 + 90)	Steel smelting	46.4 (19—63)	9.9				
Roels <i>et al.</i> (1992) (92 ~ 101)	Dry alkaline battery	31.3 \pm 7.4 (22—49)	5.3 \pm 3.5 (0.2—17.7)	0.81	0.68	0.84	0.09
Chia <i>et al.</i> (1993) (17 + 17)	Mn ore milling	36.6 \pm 12.2	7.4 \pm 4.3 (1—14)	2.53	2.33	6.1 μ g/liter	3.9 μ g/liter
Mergler <i>et al.</i> (1994) (74 + 74)	Ferro and silico alloy production	43.4 \pm 5.4 (32—58)	16.7 \pm 3.2 (1—17)	1.03	0.68	0.73	0.62
Lucchini <i>et al.</i> (1995) (n = 58)	Ferroalloy plant	38.9 (20—53)	(2—28)	1.19	0.60	2.8 μ g/liter	1.7 μ g/liter

Table 4. Blood manganese levels ($\mu\text{g/L}$) in exposed and control workers (Lucchini et al, 1999).

	Mean	Median	Range
Exposed	9.71	9.00	4-19
Control	6.00	6.00	2-9.5

Table 5. Blood manganese levels ($\mu\text{g}/\text{L}$) in the Quebec community study
(Baldwin et al, 1999; Mergler et al, 1999)

	Mean	Median	Range
All	7.50		2.5-15.9
Women	7.90	7.70	2.8-15.9
Men	7.00	6.60	2.5-13.9

Table 6. Neuropsychological Measures used in the Quebec Community Study

- Eye-hand coordination
- Rapid pointing movements
- Tremor frequency and amplitude
- Neurological exam indices
- Learning and recall
- Mood
- Psychological symptoms
- Body sway

Table 1. Signs and symptoms of manganese neurotoxicity

- Abnormal gait
- Impaired coordination
- Abnormal laughter
- Expressionless face
- Weakness
- Bradykinesia
- Somnolence
- Dysarthria
- Difficulty walking
- Clumsiness
- Lack of balance
- Muscle pains
- Diminished leg power

Table 7. Projected annual medical costs of Parkinson's disease, to age 74, based on age-related prevalence comparing baseline age distribution with onset accelerated by 5 years.

Age (2005)¹	Number (x1,000)	Base PD	Base Cost (x\$1,000)²	+5 PD	+5 Cost (x\$1,000)	Difference (x\$1,000)
35-39	20,082			823	11,160	11,160
40-44	22,634	928	12,584	1,584	21,479	8,895
45-49	22,230	1,556	21,099	9,810	133,024	111,925
50-54	19,661	8,876	120,359	23,593	321,277	200,918
55-59	16,842	28,210	382,528	52,827	716,334	333,806
60-64	12,848	40,300	546,680	92,506	1,254,381	707,701
65-69	10,086	72,619	984,714	123,458	1,674,090	689,376
70-74	8,375	102,514	1,390,090	119,218	1,616,596	226,506

¹US Census Projections

² Based on Dodel et al (1998) @ \$13,560/yr